

Amendments to the Claims

1           1.       (currently amended) Functionalized zirconium oxide particles comprising:  
2           surfaces comprising a total quantity of hydroxyl groups comprising a complexed  
3           fraction of hydroxyl groups comprising a reactive portion of hydroxyl groups  
4           and a less reactive portion of hydroxyl groups;  
5           said reactive portion of hydroxyl groups being complexed with functionalities  
6           selected from the group consisting of functionalities with high steric  
7           hindrance, functionalities with low steric hindrance, and a combination  
8           thereof;  
9           said less reactive portion of hydroxyl groups being complexed with said  
10          functionalities with ~~said groups having a low steric hindrance.~~

1           2.       (previously presented) The functionalized zirconium oxide particles of claim  
2           1 wherein said functionalities having a low steric hindrance comprise mobile adhesion  
3           promoters and said functionalities having a high steric hindrance comprise organofunctional  
4           coupling agents.

1           3.       (previously presented) The functionalized zirconium oxide particles of claim  
2           1 wherein said complexed fraction of hydroxyl groups is effective to produce a coagulation  
3           point of about 1 minute or more.

1           4.       (previously presented) The functionalized zirconium oxide particles of claim 1  
2           wherein said complexed fraction of hydroxyl groups is effective to produce a coagulation  
3           point of about 1 hour or more.

1           5.       (previously presented) The functionalized zirconium oxide particles of claim  
2       2 wherein said complexed fraction of hydroxyl groups is effective to produce a coagulation  
3       point of about 1 minute or more.

1           6.       (previously presented) The functionalized zirconium oxide particles of claim 2  
2       wherein said complexed fraction of hydroxyl groups is effective to produce a coagulation  
3       point of about 1 hour or more.

1           7.       (previously presented) The functionalized zirconium oxide particles of claim 1  
2       wherein said complexed fraction of hydroxyl groups is about 50% or more of said total  
3       quantity of hydroxyl groups.

1           8.       (previously presented) The functionalized zirconium oxide particles of claim  
2       2 wherein said organofunctional coupling agents are irreversibly complexed with said  
3       reactive portion of hydroxyl groups.

1           9.       (currently amended) The functionalized zirconium oxide particles of claim 1  
2       wherein said complexed fraction of hydroxyl groups ~~comprises~~ is substantially all of said  
3       total quantity of hydroxyl groups.

1           10.      (currently amended) The functionalized zirconium oxide particles of claim 2  
2       wherein said complexed fraction of hydroxyl groups ~~comprises~~ is substantially all of said  
3       total quantity of hydroxyl groups.

1           11.      (currently amended) The functionalized zirconium oxide particles of claim 3  
2       wherein said complexed fraction of hydroxyl groups ~~comprises~~ is substantially all of said  
3       total quantity of hydroxyl groups.

1           12.     (currently amended) The functionalized zirconium oxide particles of claim 4  
2 wherein said complexed fraction of hydroxyl groups ~~comprises~~ is substantially all of said  
3 total quantity of hydroxyl groups.

1           13.     (currently amended) The functionalized zirconium oxide particles of claim 5  
2 wherein said complexed fraction of hydroxyl groups ~~comprises~~ is substantially all of said  
3 total quantity of hydroxyl groups.

1           14.     (currently amended) The functionalized zirconium oxide particles of claim 6  
2 wherein said complexed fraction of hydroxyl groups ~~comprises~~ is substantially all of said  
3 total quantity of hydroxyl groups.

1           15.     (previously presented) Functionalized zirconium oxide particles comprising a  
2 surface comprising a total quantity of hydroxyl groups comprising a complexed fraction of  
3 hydroxyl groups and an uncomplexed fraction of hydroxyl groups, said complexed fraction  
4 of hydroxyl groups being effective to produce a coagulation point of about one minute or  
5 more after removal of a solvent from a mixture of said zirconium oxide particles and a matrix  
6 resin.

1           16.     (previously presented) The functionalized zirconium oxide particles of claim  
2 15 wherein said complexed fraction of hydroxyl groups is effective to produce a coagulation  
3 point of about one hour or more after removal of a solvent.

1           17.     (previously presented) The functionalized zirconium oxide particles of claim  
2 15 wherein said complexed portion of hydroxyl groups comprises a less reactive portion of  
3 hydroxyl groups complexed with a mobile adhesion promoter and a more reactive portion of  
4 hydroxyl groups complexed with an organofunctional coupling agent.

1           18.     (previously presented) The functionalized zirconium oxide particles of claim  
2     16 wherein said complexed portion of hydroxyl groups comprises a less reactive portion of  
3     hydroxyl groups complexed with a mobile adhesion promoter and a more reactive portion of  
4     hydroxyl groups complexed with an organofunctional coupling agent.

1           19.     (previously presented) The functionalized zirconium oxide particles of claim  
2     17 wherein the organofunctional coupling agent also comprises an adhesion promoter.

1           20.     (previously presented) The functionalized zirconium oxide particles of claim  
2     18 wherein the organofunctional coupling agent also comprises an adhesion promoter.

1           21-26. (Canceled.)

1           27.     (withdrawn) The functionalized zirconium oxide particles of claim 3 further  
2     comprising an alloying element selected from the group consisting of aluminum, phosphorus,  
3     gallium, germanium, barium, strontium, yttrium, niobium, antimony, cesium, and  
4     combinations thereof.

1           28.     (withdrawn) The functionalized zirconium oxide particles of claim 4 further  
2     comprising an alloying element selected from the group consisting of aluminum, phosphorus,  
3     gallium, germanium, barium, strontium, yttrium, niobium, antimony, cesium, and  
4     combinations thereof.

1           29.     (withdrawn) The functionalized zirconium oxide particles of claim 1 further  
2     comprising an alloying element selected from the group consisting of aluminum, phosphorus,  
3     gallium, germanium, barium, strontium, yttrium, niobium, antimony, cesium, and  
4     combinations thereof.

1           30.     (withdrawn) The functionalized zirconium oxide particles of claim 22  
2 further comprising an alloying element selected from the group consisting of aluminum,  
3 phosphorus, gallium, germanium, barium, strontium, yttrium, niobium, antimony, cesium,  
4 and combinations thereof.

1           31.     (withdrawn) The functionalized zirconium oxide particles of claim 17 further  
2 comprising an alloying element selected from the group consisting of aluminum, phosphorus,  
3 gallium, germanium, barium, strontium, yttrium, niobium, antimony, cesium, and  
4 combinations thereof.

1           32.     (withdrawn) The functionalized zirconium oxide particles of claim 18 further  
2 comprising an alloying element selected from the group consisting of aluminum, phosphorus,  
3 gallium, germanium, barium, strontium, yttrium, niobium, antimony, cesium, and  
4 combinations thereof.

1           33-38. (Canceled.)

1           39.     (withdrawn) The functionalized zirconium oxide particles of claim 1 further  
2 comprising a mixture comprising a matrix resin comprising monomers comprising functional  
3 groups polymerizable with said organofunctional coupling agents.

1           40.     (withdrawn) The functionalized zirconium oxide particles of claim 2 further  
2 comprising a mixture comprising a matrix resin comprising monomers comprising functional  
3 groups polymerizable with said organofunctional coupling agents.

1           41.     (withdrawn) The functionalized zirconium oxide particles of claim 5 further  
2 comprising a mixture comprising a matrix resin comprising monomers comprising functional  
3 groups polymerizable with said organofunctional coupling agents.

1 42. (withdrawn) The functionalized zirconium oxide particles of claim 6 further  
2 comprising a mixture comprising a matrix resin comprising monomers comprising functional  
3 groups polymerizable with said organofunctional coupling agents.

1 43. (withdrawn) The functionalized zirconium oxide particles of claim 17 further  
2 comprising a mixture comprising a matrix resin comprising monomers comprising functional  
3 groups polymerizable with said organofunctional coupling agents.

1 44. (withdrawn) The functionalized zirconium oxide particles of claim 18 further  
2 comprising a mixture comprising a matrix resin comprising monomers comprising functional  
3 groups polymerizable with said organofunctional coupling agents.

1 45. (withdrawn) The functionalized zirconium oxide particles of claim 39  
2 comprising an average diameter effective to permit curing of said mixture by  
3 photopolymerization.

1 46. (withdrawn) The functionalized zirconium oxide particles of claim 40  
2 comprising an average diameter effective to permit curing of said mixture by  
3 photopolymerization.

1 47. (withdrawn) The functionalized zirconium oxide particles of claim 41  
2 comprising an average diameter effective to permit curing of said mixture by  
3 photopolymerization.

1 48. (withdrawn) The functionalized zirconium oxide particles of claim 42  
2 comprising an average diameter effective to permit curing of said mixture by  
3 photopolymerization.

1           49. (withdrawn) The functionalized zirconium oxide particles of claim 43  
2 comprising an average diameter effective to permit curing of said mixture by  
3 photopolymerization.

1           50. (withdrawn) The functionalized zirconium oxide particles of claim 44  
2 comprising an average diameter effective to permit curing of said mixture by  
3 photopolymerization.

1           51. (currently amended) The functionalized zirconium oxide particles of claim 2  
2 wherein a sufficient quantity of said reactive portion of hydroxyl groups is complexed with  
3 an organofunctional coupling agent ~~to provide fracture toughness of a cured composite~~  
4 ~~comprising said functionalized zirconium oxide particles that, upon addition to a resin and~~  
5 curing to form a filled composite, the cured filled composite has a fracture toughness  
6 substantially the same as said resin alone, upon curing.

1           52. (currently amended) The functionalized zirconium oxide particles of claim 5  
2 wherein a sufficient quantity of said reactive portion of hydroxyl groups is complexed with  
3 said organofunctional coupling agent ~~to provide fracture toughness of a cured composite~~  
4 ~~comprising said functionalized zirconium oxide particles that, upon addition to a resin and~~  
5 curing to form a filled composite, the cured filled composite has a fracture toughness  
6 substantially the same as the cured resin alone, upon curing.

1           53. (currently amended) The functionalized zirconium oxide particles of claim 6  
2 wherein a sufficient quantity of said reactive portion of hydroxyl groups is complexed with  
3 said organofunctional coupling agent ~~to provide fracture toughness of a cured composite~~  
4 ~~comprising said functionalized zirconium oxide particles that, upon addition to a resin and~~

5 curing to form a filled composite, the cured filled composite has a fracture toughness  
6 substantially the same as the cured resin alone, upon curing.

1 54. (currently amended) The functionalized zirconium oxide particles of claim 17  
2 wherein a sufficient quantity of said reactive portion of hydroxyl groups is complexed with  
3 said organofunctional coupling agent ~~to provide fracture toughness of a cured composite~~  
4 ~~comprising said functionalized zirconium oxide particles that, upon addition to a resin and~~  
5 curing to form a filled composite, the cured filled composite has a fracture toughness  
6 substantially the same as the cured resin alone, upon curing.

1 55. (currently amended) The functionalized zirconium oxide particles of claim 18  
2 wherein a sufficient quantity of said reactive portion of hydroxyl groups is complexed with  
3 said organofunctional coupling agent ~~to provide fracture toughness of a cured composite~~  
4 ~~comprising said functionalized zirconium oxide particles that, upon addition to a resin and~~  
5 curing to form a filled composite, the cured filled composite has a fracture toughness  
6 substantially the same as the cured resin alone, upon curing.

1 56. (previously presented) The functionalized zirconium oxide particles of claim 2  
2 wherein the organofunctional coupling agent comprises a polymerizable group selected from  
3 the group consisting of one or more vinyl groups, acryl groups, epoxy groups, and methacryl  
4 groups.

1 57. (previously presented) The functionalized zirconium oxide particles of claim 5  
2 wherein the organofunctional coupling agent comprises a polymerizable group selected from  
3 the group consisting of one or more vinyl groups, acryl groups, epoxy groups, and methacryl  
4 groups.



1        58.     (previously presented) The functionalized zirconium oxide particles of claim  
2     6 wherein the organofunctional coupling agent comprises a polymerizable group selected  
3     from the group consisting of one or more vinyl groups, acryl groups, epoxy groups, and  
4     methacryl groups.

1        59.     (previously presented) The functionalized zirconium oxide particles of claim  
2     17 wherein the organofunctional coupling agent comprises a polymerizable group selected  
3     from the group consisting of one or more vinyl groups, acryl groups, epoxy groups, and  
4     methacryl groups.

1        60.     (previously presented) The functionalized zirconium oxide particles of claim  
2     18 wherein the organofunctional coupling agent comprises a polymerizable group selected  
3     from the group consisting of one or more vinyl groups, acryl groups, epoxy groups, and  
4     methacryl groups.

1        61.     (previously presented) The functionalized zirconium oxide particles of claim  
2     56 wherein the organofunctional coupling agent comprises a functionality selected from the  
3     group consisting of mono-, di-, and tri-functional silanes, isocyanates, zirconates,  
4     aluminozirconates, zirconyl methacrylate, titanates, and phosphonates.

1        62.     (previously presented) The functionalized zirconium oxide particles of claim  
2     57 wherein the organofunctional coupling agent comprises a functionality selected from the  
3     group consisting of mono-, di-, and tri-functional silanes, isocyanates, zirconates,  
4     aluminozirconates, zirconyl methacrylate, titanates, and phosphonates.

1        63.     (previously presented) The functionalized zirconium oxide particles of claim  
2     58 wherein the organofunctional coupling agent comprises a functionality selected from the

3 group consisting of mono-, di-, and tri-functional silanes, isocyanates, zirconates,  
4 aluminozirconates, zirconyl methacrylate, titanates, and phosphonates.

1 64. (previously presented) The functionalized zirconium oxide particles of claim  
2 59 wherein the organofunctional coupling agent comprises a functionality selected from the  
3 group consisting of mono-, di-, and tri-functional silanes, isocyanates, zirconates,  
4 aluminozirconates, zirconyl methacrylate, titanates, and phosphonates.

1 65. (previously presented) The functionalized zirconium oxide particles of claim  
2 60 wherein the organofunctional coupling agent comprises a functionality selected from the  
3 group consisting of mono-, di-, and tri-functional silanes, isocyanates, zirconates,  
4 aluminozirconates, zirconyl methacrylate, titanates, and phosphonates.

1           66.   (currently amended) The functionalized zirconium oxide particles of claim 2  
2 wherein the organofunctional groups are hydrolyzable zirconates having the following  
3 general structure:

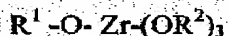


5 wherein

6           R<sup>1</sup> is selected from the group consisting of hydrolyzable alkyl groups having 1 or  
7           more carbon atoms and hydrolyzable alkenyl groups having 1 or more carbon  
8           atoms; and

9           R<sup>2</sup> is selected from the group consisting of copolymerizable alkenyl substituents  
10           containing 2 or more carbon atoms.

1           67.   (currently amended) The functionalized zirconium oxide particles of claim 5  
2 wherein the organofunctional groups are hydrolyzable zirconates having the following  
3 general structure:

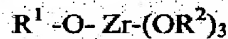


5 wherein

6           R<sup>1</sup> is selected from the group consisting of hydrolyzable alkyl groups having 1 or  
7           more carbon atoms and hydrolyzable alkenyl groups having 1 or more carbon  
8           atoms; and

9           R<sup>2</sup> is selected from the group consisting of copolymerizable alkenyl substituents  
10           containing 2 or more carbon atoms.

1           68.     (currently amended) The functionalized zirconium oxide particles of claim 6  
2     wherein the organofunctional groups are hydrolyzable zirconates having the following  
3     general structure:

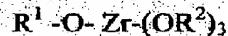


4           wherein

5           R<sup>1</sup> is selected from the group consisting of hydrolyzable alkyl groups having 1 or  
6           more carbon atoms and hydrolyzable alkenyl groups having 1 or more carbon  
7           atoms; and

8           R<sup>2</sup> is selected from the group consisting of copolymerizable alkenyl substituents  
9           containing 2 or more carbon atoms.

10           69.     (currently amended) The functionalized zirconium oxide particles of claim 17  
1     wherein the organofunctional groups are hydrolyzable zirconates having the following  
2     general structure:



3           wherein

4           R<sup>1</sup> is selected from the group consisting of hydrolyzable alkyl groups having 1 or  
5           more carbon atoms and hydrolyzable alkenyl groups having 1 or more carbon  
6           atoms; and

7           R<sup>2</sup> is selected from the group consisting of copolymerizable alkenyl substituents  
8           containing 2 or more carbon atoms.

1           70.     (currently amended) The functionalized zirconium oxide particles of claim  
2     18 wherein the organofunctional groups are hydrolyzable zirconates having the following  
3     general structure:



5     wherein

6            $R^1$  is selected from the group consisting of hydrolyzable alkyl groups having 1 or  
7           more carbon atoms and hydrolyzable alkenyl groups having 1 or more carbon  
8           atoms; and

9            $R^2$  is selected from the group consisting of copolymerizable alkenyl substituents  
10          containing 2 or more carbon atoms.

1           71.     (currently amended) The functionalized zirconium oxide particles of claim 66  
2     wherein  $R^1$  is selected from the group consisting of hydrolyzable alkyl groups having from  
3     about 1 to about 9 carbon atoms.

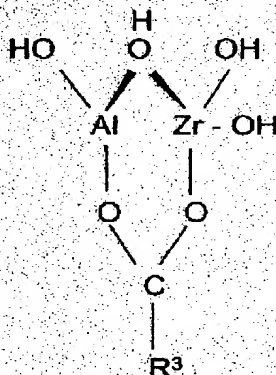
1           72.     (currently amended) The functionalized zirconium oxide particles of claim 67  
2     wherein  $R^1$  is selected from the group consisting of hydrolyzable alkyl groups having from  
3     about 1 to about 9 carbon atoms.

1           73.     (currently amended) The functionalized zirconium oxide particles of claim 68  
2     wherein  $R^1$  is selected from the group consisting of hydrolyzable alkyl groups having from  
3     about 1 to about 9 carbon atoms.

1           74.     (currently amended) The functionalized zirconium oxide particles of claim 69  
2     wherein  $R^1$  is selected from the group consisting of hydrolyzable alkyl groups having from  
3     about 1 to about 9 carbon atoms.

1           75.     (currently amended) The functionalized zirconium oxide particles of claim  
2     70 wherein  $R^1$  is selected from the group consisting of hydrolyzable alkyl groups having  
3     from about 1 to about 9 carbon atoms.

1           76.     (withdrawn) The functionalized zirconium oxide particles of claim 2 wherein  
2     the organofunctional coupling agents comprise moieties selected from the group consisting  
3     of neopentyl (diallyl) oxy trimethacryl zirconates, neopentyl (diallyl) oxy triacryl zirconates,  
4     and aluminozirconates having the following general structure:

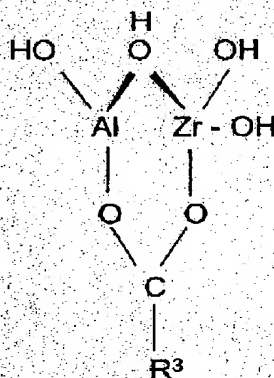


5  
6     wherein  $R^3$  is selected from the group consisting of copolymerizable alkenyl groups and  
7     carboxyfunctional substituents containing 1 or more carbon atoms.

1           77.     (withdrawn) The functionalized metal oxide particles of claim 5 wherein the  
2     organofunctional coupling agents comprise moieties selected from the group consisting of  
3     neopentyl (diallyl) oxy trimethacryl zirconates, neopentyl (diallyl) oxy triacryl zirconates,  
4     and aluminozirconates having the following general structure: wherein  $R^3$  is selected from

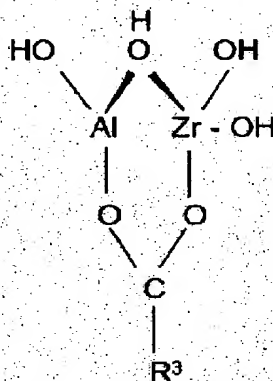
5 the group consisting of copolymerizable alkenyl groups and carboxyfunctional substituents  
6 containing 1 or more carbon atoms.

1 78. (withdrawn) The functionalized zirconium oxide particles of claims 6 wherein  
2 the organofunctional coupling agents comprise moieties selected from the group consisting  
3 of neopentyl (diallyl) oxy trimethacryl zirconates, neopentyl (diallyl) oxy triacryl zirconates,  
4 and aluminozirconates having the following general structure:



5  
6 wherein R<sup>3</sup> is selected from the group consisting of copolymerizable alkenyl groups and  
7 carboxyfunctional substituents containing 1 or more carbon atoms.

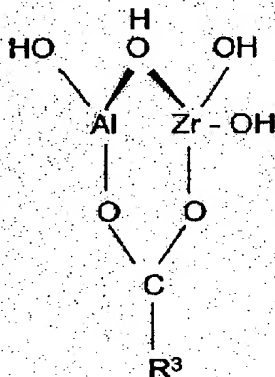
1 79. (withdrawn) The functionalized zirconium oxide particles of claim 17 wherein  
2 the organofunctional coupling agent comprise moieties selected from the group consisting  
3 of neopentyl (diallyl) oxy trimethacryl zirconates, neopentyl (diallyl) oxy triacryl zirconates,  
4 and aluminozirconates having the following general structure:



5

6 wherein R<sup>3</sup> is selected from the group consisting of copolymerizable alkenyl groups and  
7 carboxyfunctional substituents containing 1 or more carbon atoms.

1 80. (withdrawn) The functionalized zirconium oxide particles of claim 18 wherein  
2 the organofunctional coupling agents comprise moieties selected from the group consisting  
3 of neopentyl (diallyl) oxy trimethacryl zirconates, neopentyl (diallyl) oxy triacryl zirconates,  
4 and aluminozirconates having the following general structure:



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7 wherein R<sup>3</sup> is selected from the group consisting of copolymerizable alkenyl groups and  
8 carboxyfunctional substituents containing 1 or more carbon atoms.

1 81. (withdrawn) The functionalized zirconium oxide particles of claim 2 wherein  
2 said organofunctional coupling agents are methacryloxy aluminozirconates.

1 82. (withdrawn) The functionalized zirconium oxide particles of claim 5 wherein  
2 said organofunctional coupling agents are methacryloxy aluminozirconates.

1 83. (withdrawn) The functionalized zirconium oxide particles of claim 6 wherein  
2 said organofunctional coupling agents are methacryloxy aluminozirconates.

1 84. (withdrawn) The functionalized zirconium metal oxide particles of claim 17  
2 wherein said organofunctional coupling agents are methacryloxy aluminozirconates.

1 85. (withdrawn) The functionalized zirconium oxide particles of claim 18 wherein  
2 said organofunctional coupling agents are methacryloxy aluminozirconates.

1 86. (currently amended) Functionalized zirconium oxide particles comprising:  
2 surfaces comprising a total quantity of hydroxyl groups comprising a complexed  
3 fraction of hydroxyl groups comprising a reactive portion of hydroxyl groups  
4 and a less reactive portion of hydroxyl groups;  
5 said reactive portion of hydroxyl groups being complexed with functionalities  
6 selected from the group consisting of functionalities with high steric  
7 hindrance, functionalities with low steric hindrance, and a combination  
8 thereof;

9 said less reactive portion of hydroxyl groups being complexed with said functionalities with  
 10 said groups having a low steric hindrance;  
 11 wherein one or more of said functionalities with high steric hindrance and said  
 12 functionalities with low steric hindrance is bound to the oxide surface via an  
 13 ester linkage to a phosphonate group.

1           87.     (previously presented) The functionalized zirconium oxide particles of claim  
2     2 wherein one or more of said organofunctional coupling agent and said mobile adhesion  
3     promoter is bound to the oxide surface via an ester linkage to a phosphonate group.

1           88.     (previously presented) The functionalized zirconium oxide particles of claim 5  
2     wherein one or more of said organofunctional coupling agents and said mobile adhesion  
3     promoter is bound to the oxide surface via an ester linkage to a phosphonate group.

1           89.     (previously presented) The functionalized zirconium oxide particles of claim 6  
2     wherein one or more of said organofunctional coupling agents and said less reactive  
3     functionalities is bound to the oxide surface via an ester linkage to a phosphonate group.

1           90.     (previously presented) The functionalized zirconium oxide particles of claim  
2     17 wherein one or more of said organofunctional coupling agents and said less reactive  
3     functionalities is bound to the oxide surface via an ester linkage to a phosphonate group.

1           91.     (previously presented) The functionalized zirconium oxide particles of claim  
2     18 wherein one or more of said organofunctional coupling agents and said less reactive  
3     functionalities is bound to the oxide surface via an ester linkage to a phosphonate group.

1           92.     (previously presented) The functionalized zirconium oxide particles of claim  
2     86 wherein said phosphonate group comprises a silyl ester which may or may not comprise a  
3     polymerizable group.

1           93.     (previously presented) The functionalized zirconium oxide particles of claim  
2     87 wherein said phosphonate group comprises a silyl ester which may or may not comprise a  
3     polymerizable group.

1           94.     (previously presented) The functionalized zirconium oxide particles of claim  
2     88 wherein said phosphonate group comprises a silyl ester which may or may not comprise a  
3     polymerizable group.

1           95.     (previously presented) The functionalized zirconium oxide particles of claim  
2     89 wherein said phosphonate group comprises a silyl ester which may or may not comprise a  
3     polymerizable group.

1           96.     (previously presented) The functionalized zirconium oxide particles of claim  
2     90 wherein the phosphonate group comprises a silyl ester which may or may not comprise a  
3     polymerizable group.

1           97.     (previously presented) The functionalized zirconium oxide particles of claim  
2     91 wherein the phosphonate group comprises a silyl ester which may or may not comprise a  
3     polymerizable group.

1           98.     (previously presented) The functionalized zirconium oxide particles of claim 1  
2     wherein the functionality with low steric hindrance is selected from the group consisting of  
3     silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4     linked fatty acids.

1           99.     (previously presented) The functionalized zirconium oxide particles of claim 2  
2     wherein the mobile adhesion promoter is selected from the group consisting of silanes,  
3     phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester linked fatty  
4     acids.

1           100.    (previously presented) The functionalized zirconium oxide particles of claim 5  
2     wherein the mobile adhesion promoter is selected from the group consisting of silanes,

3 phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester linked fatty  
4 acids.

1 101. (previously presented) The functionalized zirconium oxide particles of claim 6  
2 wherein the mobile adhesion promoter is selected from the group consisting of silanes,  
3 phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester linked fatty  
4 acids.

1 102. (previously presented) The functionalized zirconium oxide particles of claim  
2 17 wherein the mobile adhesion promoter is selected from the group consisting of silanes,  
3 phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester linked fatty  
4 acids.

1 103. (previously presented) The functionalized zirconium oxide particles of claim  
2 18 wherein the mobile adhesion promoter is selected from the group consisting of silanes,  
3 phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester linked fatty  
4 acids.

1 104. (previously presented) The functionalized zirconium oxide particles of claim 2  
2 wherein the mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 105. (previously presented) The functionalized zirconium oxide particles of claim 5  
2 wherein the mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 106. (previously presented) The zirconium oxide particles of claim 6 wherein the  
2 mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 107. (previously presented) The zirconium oxide particles of claim 17 wherein the  
2 mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1           108. (previously presented) The zirconium oxide particles of claim 18 wherein the  
2 mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1           109. (previously presented) The zirconium oxide particles of claim 1 having an  
2 average diameter of from about 10 to about 150 nanometers.

1           110. (previously presented) The zirconium oxide particles of claim 2 having an  
2 average diameter of from about 10 to about 150 nanometers.

1           111. (previously presented) The zirconium oxide particles of claim 3 having an  
2 average diameter of from about 10 to about 150 nanometers.

1           112. (previously presented) The zirconium oxide particles of claim 4 having an  
2 average diameter of from about 10 to about 150 nanometers.

1           113. (withdrawn) A composition comprising the zirconium oxide particles of claim  
2 2 and a matrix comprising at least one monomer comprising a polymerizable group which is  
3 polymerizable with the organofunctional coupling agent.

1           114. (withdrawn) A composition comprising the zirconium oxide particles of claim  
2 5 and a matrix comprising at least one monomer comprising a polymerizable group which is  
3 polymerizable with the organofunctional coupling agent.

1           115. (withdrawn) A composition comprising the zirconium oxide particles of claim  
2 6 and a matrix comprising at least one monomer comprising a polymerizable group which is  
3 polymerizable with the organofunctional coupling agent.

1        116. (withdrawn) A composition comprising the zirconium oxide particles of  
2 claim 18 and a matrix comprising at least one monomer comprising a polymerizable group  
3 which is polymerizable with the organofunctional coupling agent.

1        117. (withdrawn) A composite comprising the composition of claim 113 wherein  
2 said polymerizable group and said organofunctional coupling agent are copolymerized.

1        118. (withdrawn) A composite comprising the composition of claim 114 wherein  
2 said polymerizable group and said organofunctional coupling agent are copolymerized.

1        119. (withdrawn) A composite comprising the composition of claim 115 wherein  
2 said polymerizable group and said organofunctional coupling agent are copolymerized.

1        120. (withdrawn) A composite comprising the composition of claim 116 wherein  
2 said polymerizable group and said organofunctional coupling agent are copolymerized.

1        121. (withdrawn) The composition of claim 113 comprising a dental restorative  
2 composition.

1        122. (withdrawn) The composition of claim 117 comprising a dental restorative  
2 composition.

1        123. (withdrawn) The composition of claim 113 comprising a prototyping  
2 composition.

1        124. (withdrawn) The composition of claim 117 comprising a prototyping  
2 composition.

1        125-127. (Canceled.)



1           128. (previously presented) The functionalized zirconium oxide particles of claim  
2   5 wherein the organofunctional coupling agents comprise moieties selected from the group  
3   consisting of neopentyl (diallyl) oxy trimethacryl zirconates and neopentyl (diallyl) oxy  
4   triacyl zirconates.

1           129. (previously presented) The functionalized zirconium oxide particles of claim 2  
2   wherein the organofunctional coupling agents comprise moieties selected from the group  
3   consisting of neopentyl (diallyl) oxy trimethacryl zirconates and neopentyl (diallyl) oxy  
4   triacyl zirconates.

1           130. (previously presented) The functionalized zirconium oxide particles of claim  
2   66 wherein the organofunctional coupling agents comprise moieties selected from the group  
3   consisting of neopentyl (diallyl) oxy trimethacryl zirconates and neopentyl (diallyl) oxy  
4   triacyl zirconates.

1           131. (previously presented) The functionalized zirconium oxide particles of claim  
2   70 wherein the organofunctional coupling agents comprise moieties selected from the group  
3   consisting of neopentyl (diallyl) oxy trimethacryl zirconates and neopentyl (diallyl) oxy  
4   triacyl zirconates.

1           132. (canceled)

1           133. (currently amended) The functionalized zirconium oxide particles of claim 8  
2   wherein the organofunctional ~~groups~~ coupling agents comprise moieties selected from the  
3   group consisting of neopentyl (diallyl) oxy trimethacryl zirconates and neopentyl (diallyl)  
4   oxy triacyl zirconates.

1           134. (canceled)



1        135. (currently amended) The functionalized ~~metal-~~ zirconium oxide particles of  
2 claim 66 wherein the mobile adhesion promoter is selected from the group consisting of  
3 silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4 linked fatty acids.

1        136. (currently amended) The functionalized ~~metal-~~ zirconium oxide particles of  
2 claim 70 wherein the mobile adhesion promoter is selected from the group consisting of  
3 silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4 linked fatty acids.

1        137. (currently amended) The functionalized ~~metal-~~ zirconium oxide particles of  
2 claim 71 wherein the mobile adhesion promoter is selected from the group consisting of  
3 silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4 linked fatty acids.

1        138. (currently amended) The functionalized ~~metal-~~ zirconium oxide particles of  
2 claim 75 wherein the mobile adhesion promoter is selected from the group consisting of  
3 silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4 linked fatty acids.

1        139. (currently amended) The functionalized ~~metal-~~ zirconium oxide particles of  
2 claim 130 wherein the mobile adhesion promoter is selected from the group consisting of  
3 silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4 linked fatty acids.

1 140. (currently amended) The functionalized metal-zirconium oxide particles of  
2 claim 131 wherein the mobile adhesion promoter is selected from the group consisting of  
3 silanes, phosphonates, phosphates, chelating agents, fatty acids, fatty alcohols, and ester  
4 linked fatty acids.

1 141. (canceled)

1 142. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 8 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 143. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 10 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 144. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 66 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 145. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 70 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 146. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 71 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 147. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 75 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1 148. (canceled)

1 149. (currently amended) The ~~metal~~-functionalized zirconium oxide particles of  
2 claim 129 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1        150. (currently amended) The ~~metal-functionalized zirconium~~ oxide particles of  
2 claim 130 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1        151. (currently amended) The ~~metal-functionalized zirconium~~ oxide particles of  
2 claim 131 wherein said mobile adhesion promoter comprises dimethyl ethoxy vinyl silane.

1        152. (canceled)

1        153. (canceled)

1        154. (previously presented) The functionalized zirconium oxide particles of claim 2  
2 wherein said complexed fraction of hydroxyl groups is about 50% or more of said total  
3 quantity of hydroxyl groups.

1        155. (previously presented) The functionalized zirconium oxide particles of claim 5  
2 wherein said complexed fraction of hydroxyl groups is about 50% or more of said total  
3 quantity of hydroxyl groups.

1        156. (previously presented) The functionalized zirconium oxide particles of claim 6  
2 wherein said complexed fraction of hydroxyl groups is about 50% or more of said total  
3 quantity of hydroxyl groups.

1        157. (previously presented) The functionalized zirconium oxide particles of claim 8  
2 wherein said complexed fraction of hydroxyl groups is about 50% or more of said total  
3 quantity of hydroxyl groups.

1        158. (previously presented) The functionalized zirconium oxide particles of claim  
2 76 wherein said complexed fraction of hydroxyl groups is about 50% or more of said total  
3 quantity of hydroxyl groups.

- 1 159. (previously presented) The functionalized zirconium oxide particles of claim
- 2 149 wherein said complexed fraction of hydroxyl groups is about 50% or more of said total
- 3 quantity of hydroxyl groups.